AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A transmitter for transmitting modulation symbols in a wireless communication system, comprising:

a plurality of transmit antennas for achieving transmit diversity; ~~and~~

a space time encoder~~transmission coding matrix generator~~ for encoding ~~producing a plurality of symbol combinations with~~ a plurality of input symbols into a plurality of symbol combinations to transmit the input symbols once from each transmit antenna at each time period~~,~~ ~~forming~~ by using a transmission coding matrix with rows corresponding to transmission time periods and columns corresponding to the transmit antennas ~~from the symbol combinations~~, and outputting the symbol combinations to the transmit antennas during the transmission time periods, the symbol combinations having orthogonal symbols, inversions and conjugates of the input symbols~~at a plurality of times,~~; and

~~the transmission coding matrix having at least two columns orthogonal to each other and the symbol combinations having as elements the input symbols, the inversions and conjugates of the symbols, and symbols obtained by rotating the phases of some of the symbols once by a predetermined phase value to maximize a diversity gain~~a phase rotator part for rotating the phases of some of the symbol combinations outputted from the space time encoder by using the transmission coding matrix.

2. (Currently Amended) The transmitter of claim 1, wherein if the number of the transmit antennas is 4, the ~~transmission coding matrix generator comprises:~~

~~an~~ space time encoder ~~for generating a~~ generates the transmission coding matrix with four rows and four columns from four input symbols, and the inversions and the conjugates of the four symbols,~~;~~ and

the ~~at least two~~ phase rotator part~~rotators~~ ~~for~~ selectively ~~rotating~~ rotates the phases of symbols in the at least two ~~of the~~ columns of the transmission coding matrix by ~~the~~ a predetermined phase value.

3. (Original) The transmitter of claim 2, wherein the transmission coding matrix is one of

$$\begin{bmatrix} s_1 & s_2 & s_3^* & s_4^* \\ s_2^* & -s_1^* & s_4 & -s_3 \\ s_3 & s_4 & -s_1^* & -s_2^* \\ s_4^* & -s_3^* & -s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & -s_4^* \\ s_2^* & -s_1^* & s_4 & s_3 \\ s_3 & s_4 & -s_1^* & s_2^* \\ s_4^* & -s_3^* & -s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & -s_4^* \\ s_2^* & -s_1^* & -s_4 & -s_3 \\ s_3 & s_4 & -s_1^* & s_2^* \\ s_4^* & -s_3^* & s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & s_4^* \\ s_2^* & -s_1^* & -s_4 & s_3 \\ s_3 & s_4 & -s_1^* & -s_2^* \\ s_4^* & -s_3^* & s_2 & -s_1 \end{bmatrix}$$

$$\begin{bmatrix} s_1 & s_2 & -s_3^* & -s_4^* \\ s_2^* & -s_1^* & s_4 & -s_3 \\ s_3 & s_4 & s_1^* & s_2^* \\ s_4^* & -s_3^* & -s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & s_4^* \\ s_2^* & -s_1^* & s_4 & s_3 \\ s_3 & s_4 & s_1^* & -s_2^* \\ s_4^* & -s_3^* & -s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & -s_4^* \\ s_2^* & -s_1^* & -s_4 & s_3 \\ s_3 & s_4 & s_1^* & s_2^* \\ s_4^* & -s_3^* & s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & s_4^* \\ s_2^* & -s_1^* & -s_4 & -s_3 \\ s_3 & s_4 & s_1^* & -s_2^* \\ s_4^* & -s_3^* & s_2 & s_1 \end{bmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols.

4. (Original) The transmitter of claim 2, wherein if the input symbols are BPSK (Binary Phase Shift Keying) symbols, the transmission coding matrix is

$$U_2 = \begin{pmatrix} s_1 & s_2 & js_3 & s_4 \\ -s_2^* & s_1^* & -js_4^* & s_3^* \\ -s_4^* & -s_3^* & js_2^* & s_1^* \\ s_3 & -s_4 & -js_1 & s_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols.

5. (Original) The transmitter of claim 2, wherein if the input symbols are QPSK (Quadrature Phase Shift Keying) symbols, the transmission coding matrix is

$$U_4 = \begin{pmatrix} s_1 & s_2 & s_3 & s_4 \\ -s_2^* & s_1^* & -vs_4^* & vs_3^* \\ -s_4^* & -s_3^* & s_2^* & s_1^* \\ s_3 & -s_4 & -vs_1 & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

6. (Original) The transmitter of claim 5, wherein v is $e^{-j2\pi/3}$.

7. (Original) The transmitter of claim 2, wherein if the input symbols are 8PSK (8-ary Phase Shift Keying) symbols, the transmission coding matrix is

$$U_6 = \begin{pmatrix} s_1 & s_2 & s_3 & s_4 \\ -s_2^* & s_1^* & -vs_4^* & vs_3^* \\ -s_4^* & -s_3^* & s_2^* & s_1^* \\ s_3 & -s_4 & -vs_1 & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

8. (Original) The transmitter of claim 7, wherein v is $e^{-j5\pi/6}$.

9. (Original) The transmitter of claim 2, wherein if the input symbols are 16QAM (16-ary Quadrature Amplitude Modulation) symbols, the transmission coding matrix is

$$U_8 = \begin{pmatrix} s_1 & s_2 & s_3 & s_4 \\ -s_2^* & s_1^* & -vs_4^* & vs_3^* \\ -s_4^* & -s_3^* & s_2^* & s_1^* \\ s_3 & -s_4 & -vs_1 & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

10. (Original) The transmitter of claim 9, wherein v is $e^{-j5\pi/12}$.

11. (Original) The transmitter of claim 2, wherein if the input symbols are 64QAM (64-ary Quadrature Amplitude Modulation) symbols, the transmission coding matrix is

$$U_{10}=\begin{pmatrix} s_1 & s_2 & s_3 & s_4 \\ -s_2^* & s_1^* & -vs_4^* & vs_3^* \\ -s_4^* & -s_3^* & s_2^* & s_1^* \\ s_3 & -s_4 & -vs_1 & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

12. (Original) The transmitter of claim 11, wherein v is $e^{-j7\pi/48}$.

13. (Currently Amended) The transmitter of claim 1, wherein if the number of the transmit antennas is 3, the space time ~~transmission coding matrix generator comprises:~~ ~~an~~ encoder ~~for generating~~ generates the~~a~~ transmission coding matrix with four rows and four columns from four input symbols, and the inversions and the conjugates of the four symbols, and ~~;~~

the ~~at least two~~ phase rotator ~~rotators~~ part for selectively ~~rotating~~ rotates the phases of symbols in the at least two ~~of the~~ columns of the transmission coding matrix by ~~the~~ a predetermined phase value~~; and~~,

wherein the transmitter further comprises a column generator for generating a new column by summing the symbols of the selected two columns containing phase-rotated symbols and replacing the selected two columns with the new column, thereby generating ~~a~~the transmission coding matrix with four rows and three columns.

14. (Original) The transmitter of claim 13, wherein the transmission coding matrix generated from the encoder is one of

$$\begin{bmatrix} s_1 & s_2 & s_3^* & s_4^* \\ s_2^* & -s_1^* & s_4 & -s_3 \\ s_3 & s_4 & -s_1^* & -s_2^* \\ s_4^* & -s_3^* & -s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & -s_4^* \\ s_2^* & -s_1^* & s_4 & s_3 \\ s_3 & s_4 & -s_1^* & s_2^* \\ s_4^* & -s_3^* & -s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & -s_4^* \\ s_2^* & -s_1^* & -s_4 & -s_3 \\ s_3 & s_4 & -s_1^* & s_2^* \\ s_4^* & -s_3^* & s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & s_3^* & s_4^* \\ s_2^* & -s_1^* & -s_4 & s_3 \\ s_3 & s_4 & -s_1^* & -s_2^* \\ s_4^* & -s_3^* & s_2 & -s_1 \end{bmatrix}$$

$$\begin{bmatrix} s_1 & s_2 & -s_3^* & -s_4^* \\ s_2^* & -s_1^* & s_4 & -s_3 \\ s_3 & s_4 & s_1^* & s_2^* \\ s_4^* & -s_3^* & -s_2 & s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & s_4^* \\ s_2^* & -s_1^* & s_4 & s_3 \\ s_3 & s_4 & s_1^* & -s_2^* \\ s_4^* & -s_3^* & -s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & -s_4^* \\ s_2^* & -s_1^* & -s_4 & s_3 \\ s_3 & s_4 & s_1^* & s_2^* \\ s_4^* & -s_3^* & s_2 & -s_1 \end{bmatrix} \begin{bmatrix} s_1 & s_2 & -s_3^* & s_4^* \\ s_2^* & -s_1^* & -s_4 & -s_3 \\ s_3 & s_4 & s_1^* & -s_2^* \\ s_4^* & -s_3^* & s_2 & s_1 \end{bmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols.

15. (Original) The transmitter of claim 13, wherein if the input symbols are BPSK symbols, the transmission coding matrix is

$$U_1 = \begin{pmatrix} s_1 & \frac{s_2 + js_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^* - js_4^*}{\sqrt{2}} & s_3^* \\ -s_4^* & \frac{-s_3^* + js_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4 - js_1}{\sqrt{2}} & s_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols.

16. (Original) The transmitter of claim 13, wherein if the input symbols are QPSK symbols, the transmission coding matrix is

$$U_3=\begin{pmatrix} s_1 & \frac{s_2+s_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^*-vs_4^*}{\sqrt{2}} & vs_3^* \\ -s_4^* & \frac{-s_3^*+s_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4-vs_1}{\sqrt{2}} & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

17. (Original) The transmitter of claim 16, wherein v is $e^{-j2\pi/3}$.

18. (Original) The transmitter of claim 13, wherein if the input symbols are 8PSK symbols, the transmission coding matrix is

$$U_5=\begin{pmatrix} s_1 & \frac{s_2+s_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^*-vs_4^*}{\sqrt{2}} & vs_3^* \\ -s_4^* & \frac{-s_3^*+s_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4-vs_1}{\sqrt{2}} & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

19. (Original) The transmitter of claim 18, wherein v is $e^{-j5\pi/6}$.

20. (Original) The transmitter of claim 13, wherein if the input symbols are 16QAM symbols, the transmission coding matrix is

$$U_7=\begin{pmatrix} s_1 & \frac{s_2+s_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^*-vs_4^*}{\sqrt{2}} & vs_3^* \\ -s_4^* & \frac{-s_3^*+s_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4-vs_1}{\sqrt{2}} & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

21. (Original) The transmitter of claim 20, wherein v is $e^{-j5\pi/12}$.

22. (Original) The transmitter of claim 13, wherein if the input symbols are 64QAM symbols, the transmission coding matrix is

$$U_9=\begin{pmatrix} s_1 & \frac{s_2+s_3}{\sqrt{2}} & s_4 \\ -s_2^* & \frac{s_1^*-vs_4^*}{\sqrt{2}} & vs_3^* \\ -s_4^* & \frac{-s_3^*+s_2^*}{\sqrt{2}} & s_1^* \\ s_3 & \frac{-s_4-vs_1}{\sqrt{2}} & vs_2 \end{pmatrix}$$

where s_1, s_2, s_3 and s_4 are the four input symbols and v is the predetermined phase value.

23. (Original) The transmitter of claim 22, wherein v is $e^{-j7\pi/48}$.

24. (Cancelled)

25. (Cancelled)

26. (Cancelled)

27. (Cancelled)

28. (Cancelled)

29. (Cancelled)

30. (Cancelled)

31. (Cancelled)

32. (Cancelled)

33. (Cancelled)

34. (Cancelled)

35. (Cancelled)

36. (New) The transmitter of claim 1, wherein the transmission coding matrix has at least two columns orthogonal to each other.

37. (New) A method for transmitting modulation symbols in a wireless communication system, the method comprising steps of:

encoding a plurality of input symbols into a plurality of symbol combinations to transmit the input symbols once from each transmit antenna at each time period by using a transmission coding matrix with rows corresponding to transmission time periods and columns corresponding to the transmit antennas,

outputting the symbol combinations to the each transmit antenna during the transmission time periods, the symbol combinations having orthogonal symbols, inversions and conjugates of the input symbols, and

rotating the phases of some of the symbol combinations by using the transmission coding matrix.